Female Mate Choice in Guppies Based on Color Contrast and Sensory Exploitation

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Introduction

Many studies have shown that female guppies (*Poecilia reticulata*) are attracted to orange males. This may be a result of sensory exploitation by males, as wild guppies show a preference for eating the orange fruit of the cabrehash tree (Rodd et al. 2002). However, there is some recent evidence suggesting that female guppies prefer males with novel or unfamiliar color patterns. This may serve to maintain genetic variation through negative frequency-dependent selection (Hampton et al. 2009), especially if body color is an honest signal indicating male health (Grethner 2000).

In these experiments, we test female preference for orange in the environment. Based on sensory exploitation, we hypothesize that the female preference for orange is the strongest driver of mate choice. We predict that the female will prefer the side of the aquarium that has the most orange.

Methods

- Four 7.5-liter aquaria were divided into three sections. Light brown or orange gravel was placed in each end of the aquarium. One male was placed on each end with a single female in the center. (see figure 1.)

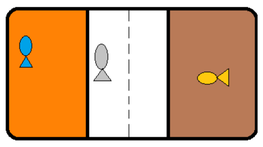

Figure 1. Diagram showing experiment setup for aquarium 1. The dividing line in the center portion was drawn on the outside of the aquarium wall nearest to the observer, and was used to distinguish one side from the other.

- Control groups and test groups were used. The control experiments were performed to observe natural variability in female swimming patterns with no males present. In each test group an orange male was compared to a similar sized non-orange male. Females were chosen randomly. Each group of three fish was used in four consecutive trials.

- Males were placed in the aquarium and females were added after a brief adjustment period. Females were observed for five minutes to record how long was spent on each side of the aquarium. We related time spent on each side to how much the female preferred that male.

Results

Control Groups

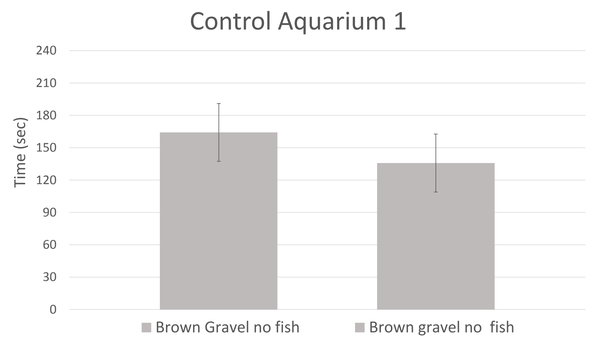

Chart 1. Mean time spent on either side of control aquarium 1. Error bars represent standard deviation from the mean. P-value=0.1290 and N=10. This is not statistically significant. This is a control experiment to observe female swimming patterns with no discriminative stimuli.

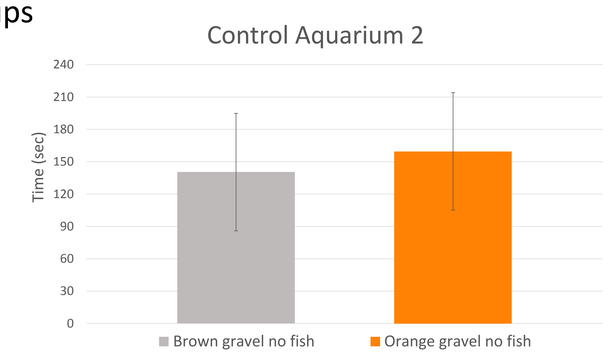

Chart 2. Mean time spent on either side of control aquarium 2. Error bars represent standard deviation from the mean. P-value=0.5908 and N=10. Although there seems to be a slight tread towards an orange preference it is not statistically significant.

Test Groups

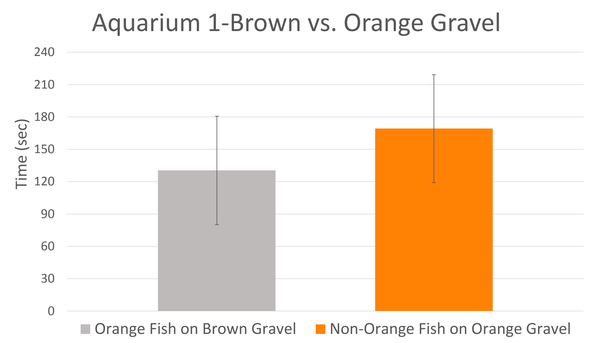

Chart 3. Mean time spent on either side of aquarium 1. Error bars represent standard deviation from the mean. P-value=0.0918 and N=21. Although the means suggest that the females preferred the side with the most orange, the data are not quite statistically significant.

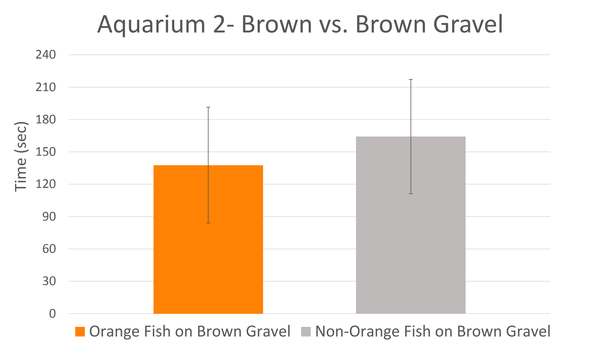

Chart 4. Mean time spent either side of aquarium 2. Error bars represent standard deviation from the mean. P-value=0.3893 and N=21. While these data is not statistically significant, it does not show a female preference for the side with the most orange.

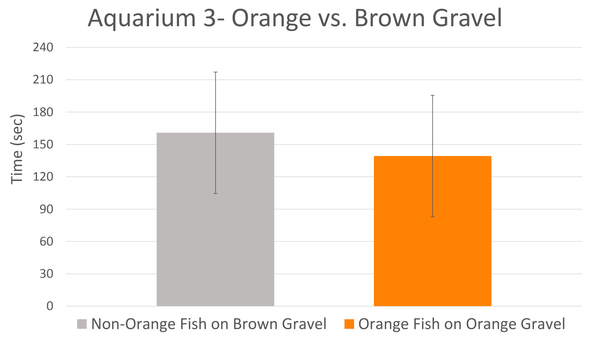

Chart 5. Mean time spent either side of aquarium 3. Error bars represent standard deviation from the mean. P-value=0.3677 and N=21. While these data is not statistically significant, it does not show a female preference for the side with the most orange.

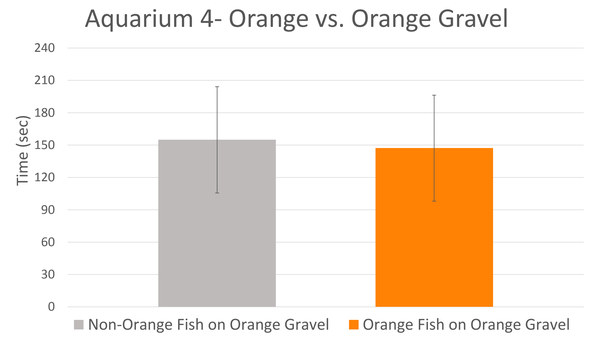

Chart 6. Mean time spent either side of aquarium 4. Error bars represent standard deviation from the mean. P-value=0.7206 and N=21. Although not statistically significant, these data do not show a female preference for the side with the most orange.

Discussion

Some of the data show trends indicating a preference for orange in female guppies. However, none of the p-values from the t-tests were statistically significant, and we failed to reject the null hypothesis. At this point we can't determine if females were choosing males due to the color orange or because of other factors such as a color contrast between the males and the environment. More trials are required to establish a connection between the color orange and female mate preference.

There were other factors in this experiment that may have affected the results. We could not account for variation in mate preference among individual females. Some females appeared completely disinterested with the males.

Figure 2. An orange male over brown gravel presents to a female.

Figure 3. A typical female.

Figure 4. A blue (non-orange) male over orange gravel presents to a female.

Sources

Grethner, G. F. 2000. Carotenoid limitation and mate preference evolution: a test of the indicator hypothesis in guppies (Poecilia reticulata). Evolution 54:1712-1724.

Hampton, K. J., Hughes, K. A., and Houde, A. E. 2009. The Allure of the Distinctive: Reduced Sexual Responsiveness of Female Guppies to 'Redundant' Male Colour Patterns. Ethology 115:475–481.

Rodd, F. H., Hughes, K. A., Grether, G. F., and Baril, C. T. 2002. A Possible Non-Sexual Origin of Mate Preference: Are Male Guppies Mimicking Fruit? Proceedings of the Royal Society B 269:475-481.

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